

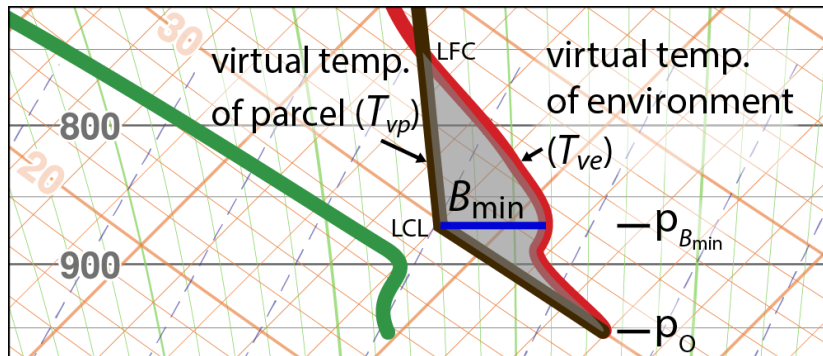
# Assessing Convective Inhibition with MPEX Soundings

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## Bmin (maximum negative buoyancy)



- Lower-tropospheric thermodynamic evolution critical to CI as  $w_{\min} = \sqrt{2CIN}$
- For  $CIN = 50 \text{ J/kg}$ ,  $w_{\min} = 10 \text{ m/s}$

- Proxy for CIN

- Analogous to using smallest (most negative) Lifted Index to characterize CAPE

### Advantages:

- Continuous field

- Unlike CIN, is defined when no positive CAPE

- More amenable to budget calculations

- Does not require vertical integration

- Conceptual simplicity, for each parcel origination level, forcing at only 2 different levels need be considered

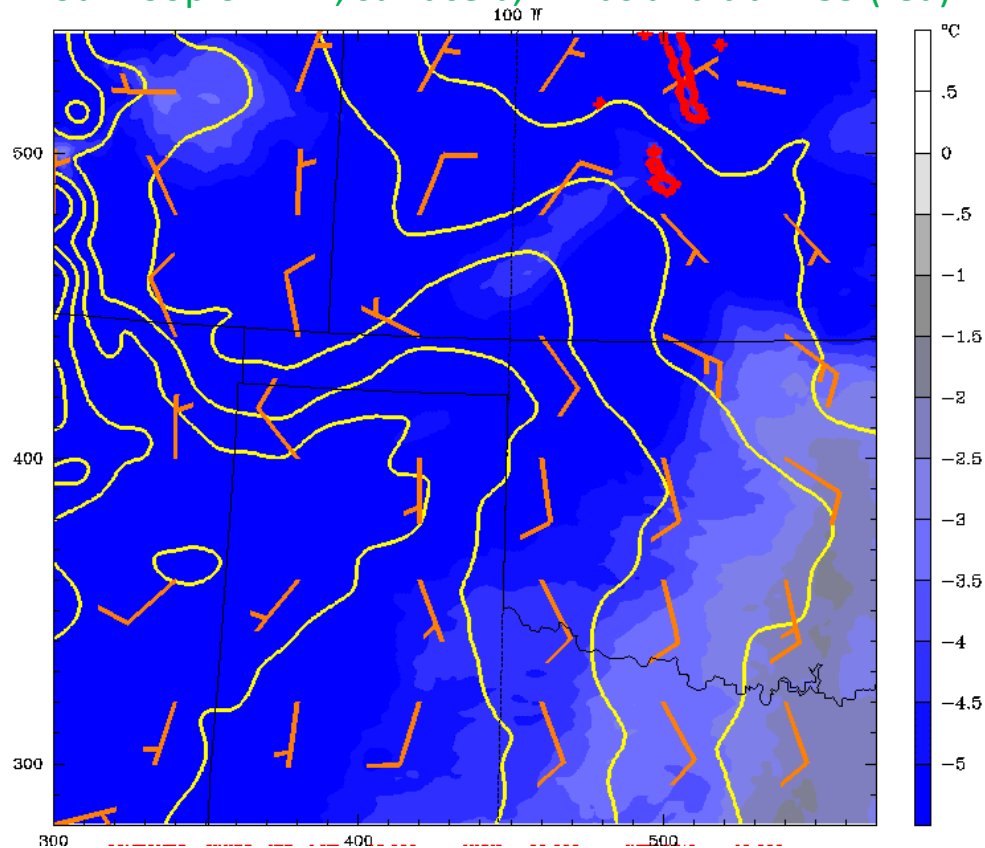
- Origination level where changes to parcel properties (e.g.,  $T_v$ ,  $q$ ,  $\theta_e$ ) can be important

- The Bmin level or some other parcel lifted level where changes to the environmental  $T_v$  can be important

# WRF Simulation (13 UTC 12 Jun to 00 UTC 13 Jun 2002)

Fcst: 1.00 h Valid: 1300 UTC Wed 12 Jun 02 (0700 MDT Wed 12 Jun 02)  
minimum buoyancy (Tv,lift-Tv,env) at k-index = 42 sm= 2

## 11-hour Loop of Bmin, surface $\theta$ , winds and dbZ >35 (red)



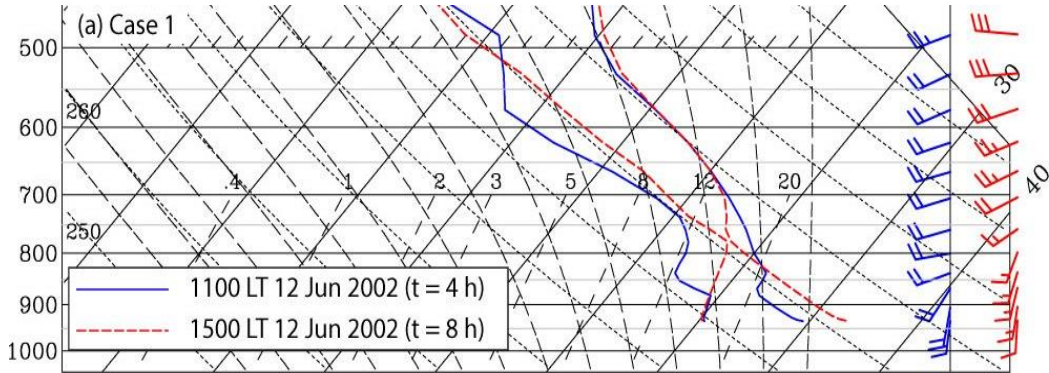
### Related Publications:

Trier, S. B., C. A. Davis, D. A. Ahijevych, and K. W. Manning, 2013: Use of maximum negative buoyancy (Bmin) to diagnose simulated thermodynamic destabilization. Part I: Methodology and case studies of MCS initiation environments. *Mon. Wea. Rev.*, doi:10.1175/MWR-D-13-00272.1, in press.

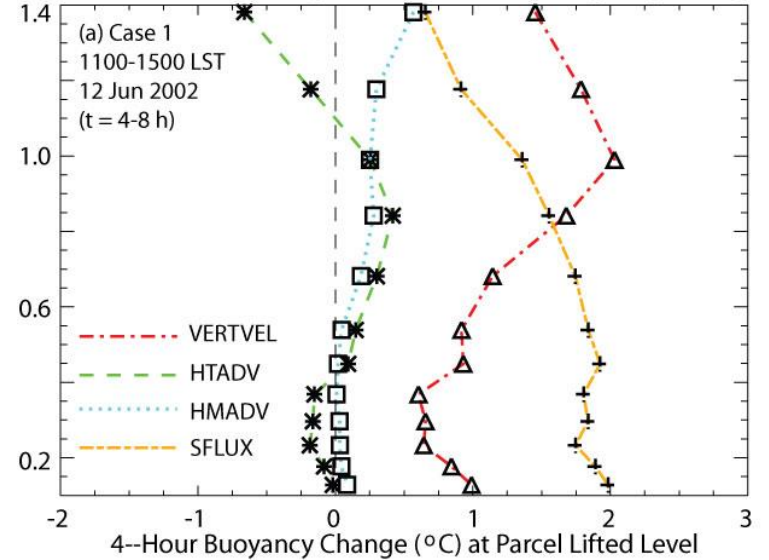
Trier, S. B., C. A. Davis, D. A. Ahijevych, and K. W. Manning, 2013: Use of maximum negative buoyancy (Bmin) to diagnose simulated thermodynamic destabilization. Part II: Composite analysis of mature MCS environments. *Mon. Wea. Rev.*, doi:10.1175/MWR-D-13-00273.1 in Press.

# Bmin Budget Calculations for Example Case

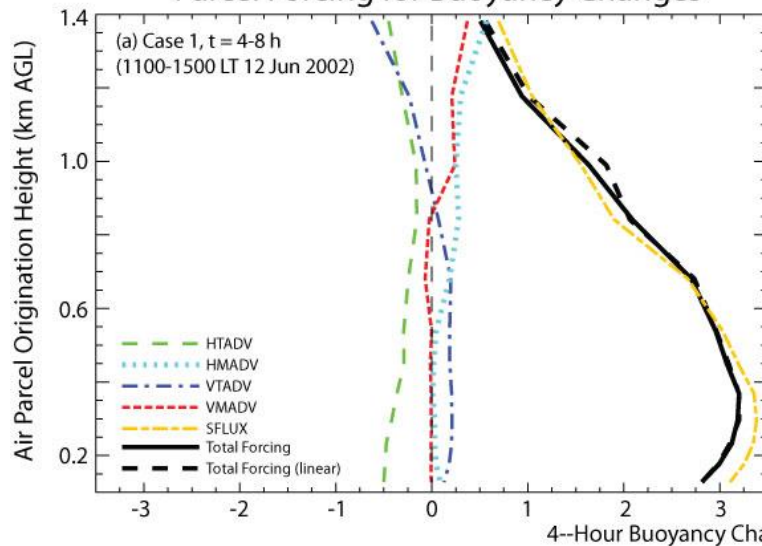
## Evolution of Soundings near Location of Convection Initiation



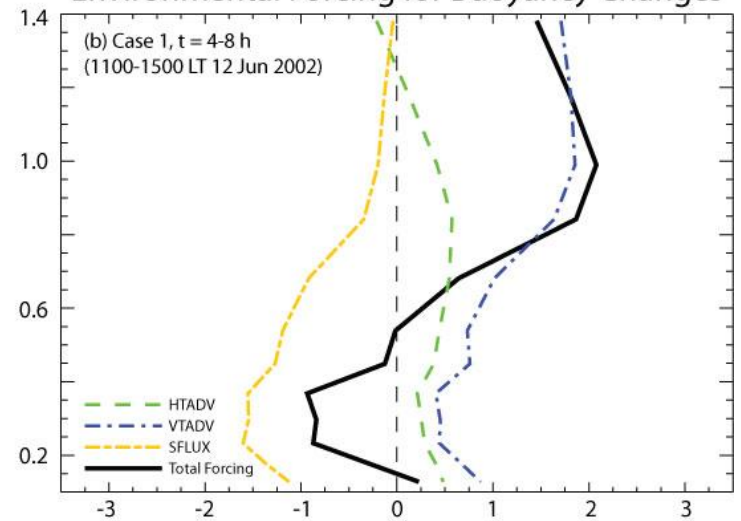
## Net Effect of Different Physical Processes on Buoyancy Change



## Parcel Forcing for Buoyancy Changes



## Environmental Forcing for Buoyancy Changes



# Remaining Questions that MPEX Sounding Data Could Help Answer

- Utility of  $B_{\min}$  trends in nowcasting convection initiation (CI)

## Advantages of $B_{\min}$ vs. CIN

- Continuous field that doesn't require there being CAPE

## Limitations of $B_{\min}$ vs. CIN

- Representativeness issues (use of only two vertical levels more subject to noise)  
Is this a significant issue for observed high vertical resolution soundings?

- Exploration of different methods for assessing inhibition

- Traditional vertical averaging of parcels vs. vertical distributions of point parcels?
- How best to utilize vertical distributions of  $B_{\min}$ /CIN values for CI forecasting?

## Future Research with MPEX cases/soundings (cont.)

- Additional model-based  $B_{\min}$  budget studies
  - Add diversity to previous studies on thermodynamic factors influencing CI  
Springtime supercell/bow-echo environments (vs. past studies of warm-season MCSs)
  - Examine different MPEX synoptic environments
  - Midtropospheric vortices/cutoffs vs. shortwaves in subtropical jet
- Collaborations with other PIs on model-based CI case studies